

Nanotechnology and its role in the Development of Contemporary Sculptural Thought

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Introduction:

Technology is the basis of every work and best execution of every design, creation of the best materials and innovation in different ways of production and implementation of smart systems. With the emergence of multiple modern technologies used in the application of modern sculpture, one of the most important of these technologies is nanotechnology that has dominated many life aspects; it has clearly affected human life and way of thinking where designers are trained to innovate using the available techniques and materials, but given the nanotechnology, the designers have to work on the creation of materials that are created specifically for their designs instead of committing to the currently available resources. Giving the scientists and doctors who have been able to use Nano-sized robots to process DNA skillfully and grow the artificial skin layer, why can't designers use the same technology to bring more than just exciting designs to life? They can create materials and artworks that were previously impossible to perform but can now be achieved.

Research problem:

Lack of role that nanotechnology can play in the development of contemporary sculptural intellect.

Research assignments:

- Usage of nanotechnology will affect the thinking methodology of designers and enable them to create ideas for revolutionary architectural sculptures.
- A relationship between nanotechnology and contemporary architectural sculpture applications that can contribute to the creation of innovative architectural sculpture applications that carry the values of artificial intelligence and meet different human needs.

Research goals:

- Activating the role of technological development in updating the intellect of the sculptor.
- Accessing innovative design ideas for nanotechnology-executed sculpture elements.

The importance of research:

- Emphasizing the role of the sculptor in making use of modern materials to show the aesthetics of architectural sculpture.
- Illustrating the importance of nanotechnology in the development of contemporary architectural sculptures.

Research Methodology:

Research follows an experimental analytical descriptive approach.

The impact of nanotechnology on the intellect of sculptors:

Sculpture is no longer just digging into a solid mass of stone like what it was to extract a statue or a sculpture, but the sculptor became -by dealing with small nanomaterials that consist of many atoms- as if dealing with a pile of dust and somehow pasting millions of those atoms to make that sculptural work that also has the required functional characteristics to saturate different human needs.

Nano-term concept:

The word Nano is derived from the word Nanos and its meaning in Greek is (extremely small), while in the field of nanometers Nano equals million millimeters or billions of meters and this length is the length of viruses & DNA and the diameter of the hydrogen atom and others, interestingly, to know more clearly this measure; growth rate of human nail per second is equal to one Nano.

Design intellect:

It is a translation of a particular topic or idea that is drawn with artistic value within it, as it is related to the means of implementation, the design is the process of innovation in assembling elements of the environment and putting them in one composition in a meaningful way that satisfies the human need.

Design has two interfaces:

- Mental appearance which is an idea that arises from a particular purpose and most design works are intended to achieve a particular purpose.
- Implementation phase in which design comes up to the artistic work that has affected our lives and from here technology can effectively influence as we always want to create new operational methods that match the materials created to employ them between utility and beauty, hence, we have to innovate to get out with artworks that are not only artistic but are functional as well.

The impact of nanotechnology on the final product:

The final design is influenced by the use of nanotechnology in two aspects:

The first aspect: influencing the designer's intellect:

Where the designer has to choose the executed materials before putting his/her idea and therefore cooperation is necessary between the designer and the constructor implementing the design to reach new materials that serve the idea of the design and help to unleash the imagination and thinking of the designer and remove any obstacles facing his/her idea.

The second aspect: the emergence of different new designs:

We find that the use of nanotechnology applications has led to the implementation of forms that were impossible to achieve, for example, highly flexible and dynamic forms, sustainable biological forms, forms that are self-dynamic and non-self-dynamic which are remotely controlled as well as performing Nano-sculptures through microscopes, as shown below:

Ferro fluid sculpture:

is one of the most important images of dynamic sculpture using nanotechnology where fluid is injected with particles of magnetic iron oxide up to 10 nm in size which can absorb magnetic electrodes inside them, making those liquids permanently magnetized without the need for a magnetic field around, one of the most famous sculptors who carried out this kind of sculpture is the Japanese artist Sachiko Kodama who began implementing this type of art in the year 2000 and her work has been exhibited in multiple museums.

Biological Sculpture:

Some sculptures have been carried out and known as 'smart sculptures' which rely on the combination of high technology and sculpture, helping to regulate temperature in order to be warm in cold weathers and cool in hot weathers in addition to other sculptures executed from environmentally friendly biological materials that do no harm, also sculptures contain a set of flexible solar cells, which make it lightening throughout the evening.

Nano sculpture:

They are Nano-sized sculptures executed with high accuracy and very precise details despite their small size by means of the 3D printer and microscopes by a group of scientists at the Vienna University of Technology.

The impact of nanotechnology applications on materials:

The impact of nanotechnology on building materials has led to the improvement of its properties, so the main goal of designers -during the design process- is how this design achieves all requirements and being satisfactory to different generations, these old materials that have been modified by that technology are called smart materials,

Accordingly, several materials will be addressed in terms of Nano additives, their impact on matter and their most important benefits are:

Nanomaterials:

Are advanced materials ranging from 1 nm to 100 nm and consist of thousands of atoms; the materials from which nanoparticles are manufactured, none of them is exceptional but the basic material of nanoparticles can be organic or inorganic.

Concrete:

Nanotechnology has influenced the production of new types of modified concrete that compensates its weakness in tensile strength and leads to a significant improvement in pressure strength in addition to the possibility of providing modern smart properties such as electrical conductivity or sensor capabilities or others, recently, concrete usage has made significant progress not only technically, but also aesthetically, hence, the material is no longer heavy and cold as before but it has become more artistic and vibrant.

Several types of modern concrete were developed such as: transparent concrete, green concrete, permeable concrete, self-healing concrete.

Wood

Wood is an ancient material that has been used since the dawn of civilization and consists of carbon hydrates and lignocellulose in its structure which can be destroyed by various factors such as ultraviolet rays, fungi, ants, beetles and chemicals, which reduce the durability of the wooden structure, but nanomaterials have been added to improve wood performance as the strength of nanofibers is considered twice the strength of steel and thus will lead to improving the structural performance of wood and its resistance and increasing its aging time and protecting it from the impact of sunlight, in addition to the ease of forming wood with the required sections and shapes for design and to be used as a construction material in flexible organic free-forming designs.

Glass:

Glass is one of the most important materials that gives the design greater transparency through the glass spaces that are being used, in addition to control the extent of its transparency. Glass sculptures are characterized by a high attractiveness among the rest types of sculptures and the addition of nanomaterials to those glass sculptures will help change the applications of glass and produce different types of it which can be implemented on these sculptures to improve their properties in terms of self-cleaning, protection from sun, heat and other properties that will help being more durable & unbreakable and therefore can be implemented in public fields and open areas.

Steel:

Research has shown that the used copper nanoparticles work on strengthening of compression power, which prevents the occurrence of cracks and increases durability of iron. Regarding welding, we find that magnesium and calcium granules which are under heat pressure increase the hardness of that welding which makes the iron more durable to carry out high-rise sculptural works, besides, being of light weight making it easy to be moved.

Anti-coating:

It is a very thin layer of paint treated with nanotechnology which saves the material from writing on it without closing its pores, allowing maintaining its permeability as it reduces the accumulation of dirt and water significantly on its surface. An example for that was executed on the most famous historical landmarks of the Brandenburg Gate in Berlin.

Conclusion:

- Nanotechnology has had an impact on the thinking methodology of designers.
- The appearance of materials and techniques in sculpture that did not exist before.
- The sculptor's use of nanomaterials has created huge artworks that are smart and have functional characteristics that are meeting human needs.
- Nanotechnology has a huge impact on future economic returns in terms of frequent construction and high maintenance costs.

Recommendation

- Studying nanotechnology in order to produce new materials that help developing the field of design and implementation of architectural sculpture in Egypt.
- Paying attention to the implementation of sculptures with nanomaterials to be environmentally friendly and to achieve sustainability in them to become suitable for different generations.
- Establishing specialized centers in nanotechnology to do scientific research on materials and improve their properties.
- Ensuring the safety and taking precautions regarding dealing with nanotechnology because of the small size of the material particles that may enter into the human body through skin pores and thus cause significant damage to it.
- Having professional staff to deal carefully with nanotechnology.

Reference:

- 1- Alagarasi, A. (2011). "Introduction to Nanomaterials" published book, Chapter: 1, pp.76.
- 2- Elsayed, M. (2012). 'Nanotechnology sculpture between aesthetic values and utilitarian forms' annual conference of the Faculty of Quality Education, Mansoura University.
- 3- Ganguly, S., (2012): Application of Nanotechnology in Building Materials. International Journal of Engineering Research and Applications (IJERA), Vol. 2, Issue 5, 1077-1082.
- 4- Harmens, J. (2012). "Nanotechnology Application in Building and Facade Construction of the Future" Published book 23-24, p2-5.
- 5- Hassanein, B. (2016):. 'Using nanotechnology to raise the efficiency of residential buildings is a special reference for energy and materials efficiency.', Unpublished Master's Degree, Department of Architecture, Faculty of Engineering, Cairo University, p., 76,72,26.
- 6- Hurba, O. (2017). 'Architecture under Nanotechnology', Ba'ath University Journal, Volume 39, Issue 18, p. 83-116.
- 7- Leydecker S. (2008):" Nano Materials: in Architecture, Interior Architecture and Design" Published book, p11-15, p57-174.
- 8- Loos, M. (2015). "Carbon Nanotube Reinforced Composites: CNR Polymer Science and Technology "PDL Handbook series
- 9- Mahdy, M., (2012):" Nanotechnology and Architecture" Presentation, Bibliotheca Alexandrina, November.
- 10- Mahmoud, G. (2013). 'The impact of technology on the development of the design thought of interior architecture'. Master's Degree, Department of Decoration - Interior Architecture, Faculty of Fine Arts, Helwan University.
- 11- Mohamed, A (2010) "Towards sustainable architecture with nanotechnology". AL-Azhar Engineering Eleventh International Conference, Conference Paper • December 21-23.
- 12- Saqr, AL-H. (2014). 'Nanomaterials in Architecture: Their Applications and Properties in Buildings'.

- 13- Science, alert. (2019). "We Now Have the First-Ever Permanently Magnetic Liquid, And It's Absolutely Trippy". Science. American Association for the Advancement of Science.
- 14- Surinder Mann (2006): Report on Nanotechnology and Construction; Page 1-55
- 15- Jamal, A. (2013). 'The design structure of the works of Nano artists as a source of decorative designs', unpublished Master's thesis, Department of Decorative Design, Faculty of Art Education, Helwan University, p. 134,135.